Center Innovation Fund: MSFC CIF

Fabrication and Characterization of a Grooved Ring Fuel Element for a Nuclear Thermal Rocket

Completed Technology Project (2016 - 2017)

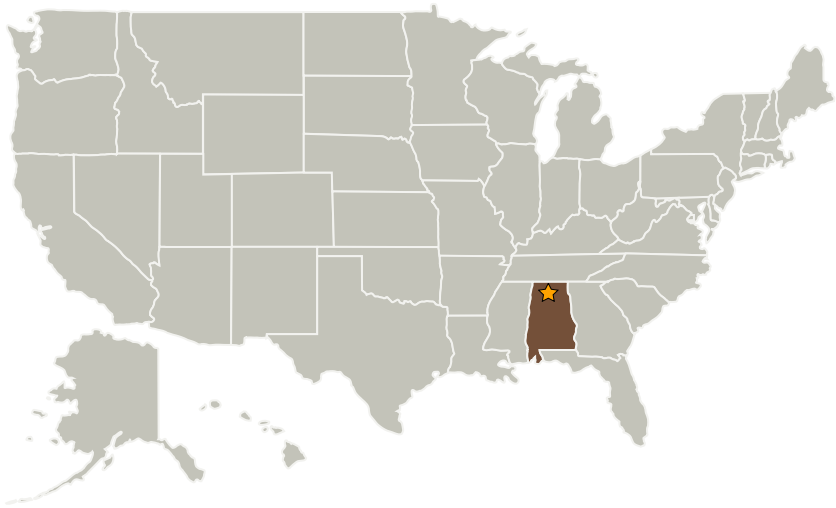
Project Introduction

The proposed innovation is a new fuel element design that involves a stack of grooved disks, where propellant can flow along the grooves. This design increases surface area in contact with propellant, leading to higher heat transfer, engine efficiency, and propellant temperatures. Higher thrust-to-weight ratios are also possible, and the design can also alleviate some of the manufacturing hurdles that exist with hexagonal elements. The approach is to (1) determine viable compositions of representative grooved disk prototypes, (2) evaluate fabrication processes through the manufacture of prototype disks, and (3) characterize the microstructure of these disks. This project will also evaluate the feasibility of incorporating advanced carbide fuels into NTR reactor designs.

Anticipated Benefits

Fuel element fabrication has proven to be a significant challenge to nuclear thermal rocket (NTR) programs. Heritage designs use hexagonal fuel elements with cylindrical passages for propellant flow, which are difficult to manufacture and have heat transfer limitations. The goals of this project are to develop an alternative grooved disk fuel element design, and to construct and test prototype fuel element disks of carbide materials. This project will help build the foundation for the development of higher performance NTR fuel elements.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations
Alabama

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Center Innovation Fund: MSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

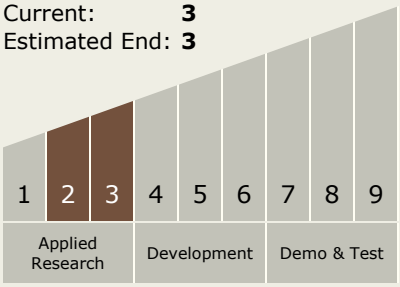
John W Dankanich

Principal Investigator:

Brian D Taylor

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.4 Advanced Propulsion
    - TX01.4.3 Nuclear Thermal Propulsion

Target Destinations

Mars, Others Inside the Solar System